

Thermal Energy and Heat ▪ *Review and Reinforce*

Thermal Energy and States of Matter

Understanding Main Ideas

Answer the following questions on a separate sheet of paper.

1. A glass of ice at 0°C changes to a glass of water at 0°C . What caused the ice to change to water?
2. Why didn't the temperature of the water change in Question 1?
3. Lengths of railway tracks have small gaps between them. Why are the tracks built this way and what might happen if there were no gaps?
4. List three states of matter.

Building Vocabulary

From the list below, choose the term that best completes each sentence.

states
freezing
boiling
change of state
condensation
melting
evaporation
thermal expansion

5. When a substance changes from a solid to a liquid, _____ occurs.
6. A solid, a liquid, and a gas are all examples of a(n) _____ of matter.
7. The change of state from a gas to a liquid is called _____.
8. When vaporization takes place on the surface of a liquid, it is called _____.
9. When vaporization takes place on and below the surface of a liquid at higher temperature, it is called _____.
10. The process by which matter changes from a liquid to a solid is called _____.
11. The expansion of matter when it is heated is known as _____.
12. The physical change from one state of matter to another is called _____.

Thermal Energy and Heat ▪ *Enrich*

Fire Sprinklers

Henry Parmalee invented fire sprinklers in 1874 to protect his piano factory in case of a fire. Fire sprinklers are designed to keep a fire from growing out of control. You have may seen fire sprinklers on the ceilings of hospitals, hotels, schools, and other buildings. Each sprinkler is connected to a pipe containing water under pressure. When the sprinkler is set off, water sprays onto the fire beneath it.

There are two ways in which fire sprinklers are set off, both of which involve heat. One type of fire sprinkler is set off when a link of solder in the sprinkler melts. *Solder* is a metal with a low melting point that is used to join, or link, pieces of metal with higher melting points. When heat from a fire raises the temperature of the solder to its melting point, the solder melts, breaking the link and setting off the sprinkler.

A second type of fire sprinkler is set off when a liquid-filled glass tube is shattered. Heat from a fire raises the temperature of the liquid inside the tube. As the liquid is heated, it expands. If the liquid gets hot enough, it will expand so much that it breaks the glass surrounding it, setting off the sprinkler.

Most fire sprinklers are designed to go off when they reach a temperature of 74°C . The temperature of a fire itself, however, would be much higher. A short distance from the sprinkler, the temperature during a fire may be more than 500°C .

Answer the following questions on the back of this sheet or on a separate sheet of paper.

1. Which type of sprinkler involves a change of state?
2. Why is it important for the melting point of the solder in a fire sprinkler to be lower than the melting points of the parts it connects?
3. Does the glass tube in a fire sprinkler expand more or less than the liquid inside the tube? How do you know?
4. All of the fire sprinklers in a buildings do not go off together. Instead, each fire sprinkler is set off individually. Why do you think fire sprinklers are designed this way?
5. How does heat move from a fire to a fire sprinkler?
6. Normal room temperature is about 25°C . Why do you think sprinklers are designed to go off at 74°C instead of a few degrees above room temperature?

